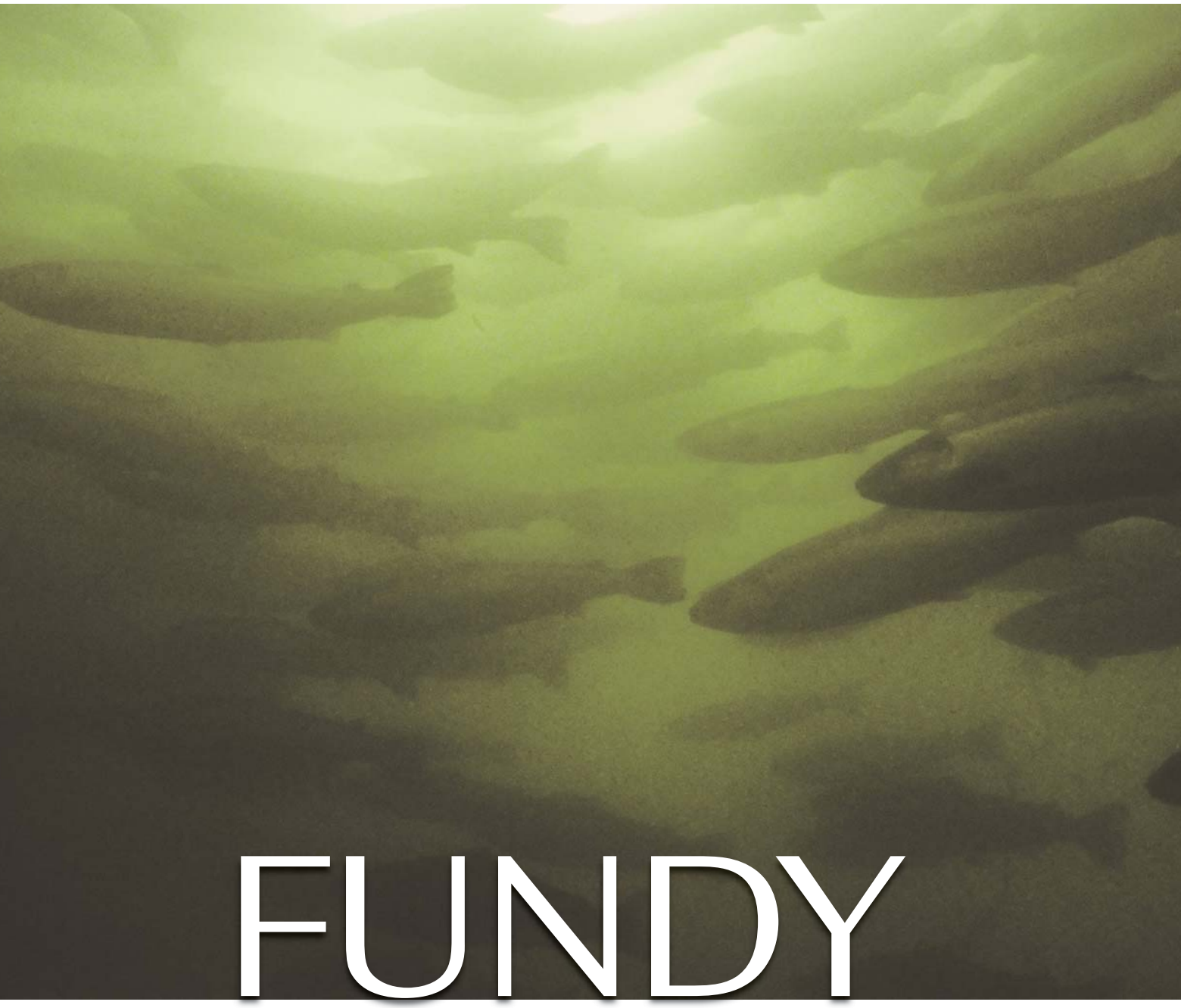

FUNDY FEEDLOTS

JOE HUNT

BAY OF FUNDY SALMON FARMS PROVIDE ONE VALUABLE SERVICE FOR THE AQUACULTURE INDUSTRY—A CASE STUDY ON HOW *NOT* TO PROCEED.

By Ted Williams

THE ADVENT OF SALMON FARMING four decades ago elicited cheers from Atlantic salmon advocates. The industry started in Norway, then swiftly expanded to Canada, Maine, Ireland, Scotland, Chile, the Faeroe Islands, Australia and New Zealand. The product was a bit fatty; but it tasted okay. We were served it at Atlantic Salmon Federation dinners. As we had predicted, the proliferation of domestic fish reduced the take of wild fish. But what we had not predicted was that one of the ways it did this was by killing them off.

In cattle and hog feedlots, uneaten feed and feces are treated or at least contained; in salmon farms they just fall from the net pens, polluting water, destroying benthic ecosystems, spreading pathogens and parasites.

And the farmed salmon themselves attract parasites. Checking for lice is not unusual human behavior; but anglers are the only people on the planet who express joy on finding them. That's because sea lice in moderation indicate bright fish fresh from the ocean. Galaxies of sea lice swirling in inshore waters indicate stressed fish jammed into enclosures.

Salmon farming, explains Dr. Alexandra Morton, director of the Salmon Coast Field Station at Simoom Sound, B.C., "breaks a natural law" by exposing juveniles to fatal attack by sea lice. In a natural system, lice remain offshore feeding on more mature salmon and doing little harm. Parasites like sea lice never evolved to kill their hosts, but unnatural swarms of lice in and around net pens do just that—directly with juveniles or by compromising immune systems and spreading disease in adults. Nowhere is this man-made infestation more dangerous than in the inner Bay of Fundy, populated by salmon that feed there instead of migrating to Greenland. The more fish, the more lice; and with close to 100 salmon-farming operations, about two-thirds of which are active in any given year, the bay holds one of the densest clusters of aquaculture sites in the world.

Among the more dangerous diseases sea lice spread is infectious salmon anemia which, until it showed up in New Brunswick in 1996, was assumed to be restricted to Europe. The industry destroyed the diseased fish it couldn't sell. But salmon farmers dilly-dallied in depopulating their pens, and the disease persisted. Eventually the province ordered a purge of 1.27 million salmon and lengthy fallowing of the sites. It then handed the farmers a $10 million bailout package.

TOM MOFFATT

From above, salmon farming looks completely benign, but beneath the surface lies an industry that has been slow to move toward sustainability. Recent improvements do offer hope, however.

Lice and pestilence are being spread to wild fish. And, as if this weren't bad enough, domestic escapees have been competing with native fish for spawning, nursery, and ocean habitat and in some rivers, cross-breeding with them—replacing healthy fry with weak, genetically limited hybrids. In November 2010, farms off Deer and Grand Manan Islands disgorged 13,000 and 33,000 salmon respectively. And the following month another farm off Grand Manan added 138,000. The industry blamed the escapes on stormy weather. But weather happens.

Not all escapes are reported. Almost two months before the biggest ones were reported in 2010, farm fugitives turned up at the Mactaquac dam on the Saint John River. Jonathan Carr, ASF's director of Research and the Environment, points out this means others probably have entered river systems on the lower Saint John, including the Keswick, Oromocto, Canaan, Nerepis, Salmon, Hammond, and Kennebecasis, all critical for survival of the Saint John's wild fish—Fundy's best hope. Before the end of October, ASF had counted 27 other escapees at its monitoring station on the Magaguadavic River.

IN AN EFFORT TO COMBAT SEA LICE, THE INDUSTRY bathes salmon in pesticide cocktails that target crustaceans, because that's what sea lice are. For years salmon farmers depended on a relatively benign treatment called Slice® that is added to salmon feed; but the lice developed immunity. Now salmon farmers run their fish through toxic solutions contained in "well-boats," then dump the contents into the sea.

TOM MOFFAT

The battle to control sea lice (left), has led to increasing use of chemical pesticides in the pens (above). Unreported escapes from storm-battered cages, such as the one in St. Mary's Bay, N.S. below, have made mitigation difficult.

Unfortunately, lobsters are crustaceans, too; and the pesticides can kill them, along with crabs and other important organisms in the marine ecosystem. In November 2009, hundreds of dead and dying lobsters contaminated with the illegal sea-louse poison Cypermethrin began turning up in pots off Pocologan, New Brunswick and near Deer and Grand Manan Islands. This precipitated a search warrant and a coordinated, 29-agent raid by Environment Canada at eight facilities owned by Cooke Aquaculture. At this writing four investigations are underway.

While Cypermethrin is illegal for general sea-lice control in Canada, some of its equally dangerous and non-selective relatives are not. "That's something the public needs to understand," says Matthew Abbot, coordinator for the Conservation Council of New Brunswick's Fundy Baykeeper Project. "It's not as if sea-louse pesticides are magically safer just because Health Canada has approved their use."

Abbot points out that Canada's Fisheries Act makes it unlawful to deposit deleterious substances such as pesticides in water and proscribes the killing of fish and crustaceans by means other than fishing. So the Council contends that salmon farming, as practiced in Canada, contravenes federal law. But the Department of Fisheries and Oceans is conflicted; in addition to regulating aquaculture, it promotes it. Abbot believes the agency is moving to exempt pesticides approved for sea lice by Health Canada from the Fisheries Act. "That's a real concern to us," he declares. "The regulator sees an industry violating the law, so instead of enforcing the law it changes it. That change would push Environment Canada out of the picture; and that's the only body we've seen do anything on the lobster issue."

There is no question that salmon farms have had a major role in the near extirpation of Atlantic salmon from the Bay of Fundy. Historically, there may have been something like 100,000 wild fish returning to about 50 rivers. Today, there are under 5,000; and if you don't count the Saint John, under 1,000. The Committee on the Status of Endangered Wildlife in Canada recommends that all wild salmon stocks in the bay be designated endangered under the Federal Species at Risk Act.

The crash appears to be feeding on itself by exacerbating pesticide resistance in sea lice. If the Bay of Fundy supported natural numbers of salmon, thousands of unexposed lice would be arriving, and they'd pass on non-immunity to lice infesting salmon farms. "This process may be underway in areas where lice show less resistance and where there are more wild salmon," remarks Dr. Fred Whoriskey, formerly with ASF and now director of the Ocean Tracking Network at Dalhousie University in Halifax. "Rivers like the Magaguadavic, right in the center of the salmon-farming industry, have fallen from 1,000 fish per year to as low as two. So here the industry is cycling within itself—a recipe for building resistance."

GREIG CRANNA

WHEN I FIRST STARTED LOOKING INTO salmon farming 15 years ago, I concentrated on Maine, where a slovenly industry, abetted by state politicians and bureaucrats, insisted on making all the old mistakes for itself. The production manager for Atlantic Salmon of Maine, Alf Aarskog, was quoted by the *Bangor Daily News* as offering this response to complaints about the obese, stump-finned escapees crowding Downeast rivers: "So what. From a genetic point of view, every river in Maine should be happy if we lost one million fish. It would prevent inbreeding." The industry and its apologists railed against listing wild salmon under the U.S. Endangered Species Act (ESA). "It will kill the industry dead, D-E-A-D, dead," proclaimed Maine governor Angus King.

But it wasn't the ESA that put all the independent farmers out of business; it was greed and stupidity. For example, fallowing is basic common sense and prerequisite in any kind of farming. Maine salmon farmers refused to do it and, as a result, lost much of their stock to infectious salmon anemia. The 2002, a pandemic required destruction of every fish in Cobscook Bay, about 1.5 million adults. Heritage Salmon, in whose pens the outbreak apparently started, was fined $15,000 for failing to report positive test results. Other outbreaks followed.

Refusal to fallow led to litigation by environmental groups and heavy fines assessed to Heritage Salmon and Atlantic Salmon of Maine for violating the Clean Water Act. Despite the pleas of biologists and salmon conservationists, the industry stubbornly refused to switch from European to North American stock. The European fish grew faster; but, because they evolved in radically different conditions, were deemed an even greater threat to native fish than North American hatchery stock. The court defined European genes as pollution under the Clean Water Act and ordered immediate depopulation. Heritage Salmon and Stolt Sea Farm—based in Canada where European stocks had long been outlawed—had North American fish on hand and were

Since ASF's Jonathan Carr helped raise the alarm at Mactaquac, reporting of escapees has vastly improved. Now, he says, more effective techniques of preventing farmed fish in damaged pens from entering rivers is required.

CHRISTINE CALLAGHAN

therefore able to convert their Maine sites. But Atlantic Salmon of Maine went bankrupt and was purchased by Cooke Aquaculture.

Instead of killing the industry "dead, D-E-A-D, dead" the ESA saved it. Impending ESA action rendered the companies sufficiently cooperative to meet with ASF, Trout Unlimited and the Conservation Law Foundation. Together, they devised a standardized containment system that used the best available hardware and best practices and was subject to independent audits. Because of this system and scrupulous fallowing, there hasn't been an escape or an application of antibiotics in Maine in the last seven years. Lice were a problem in

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2010 because of the previous warm winter, but almost a third of Maine sites have never required treatment.

From 2000 (when wild salmon in Downeast rivers were listed as endangered) to 2009, annual farmed salmon production in Maine dropped from just under 37 million to 13.3 million pounds; and one company, Cooke Aquaculture, has taken over everything. But thinning has produced a better product, and Maine operations seem secure.

WHY HASN'T CANADA ADOPTED THE Maine model? For one thing, the players are more numerous. More importantly, there is no law anywhere near as powerful as the ESA. "A ridiculous mess" is how the ASF's president, Bill Taylor, describes the net-pen-clogged Bay of Fundy.

So what can be done? One suggested solution—fully contained, land-based aquaculture—is anathema to the industry. Sebastian Belle, director of the Maine Aquaculture Association, told me this: "Any land-based containment system would have to grow fish at probably ten times the density we grow them, and that's an animal-welfare issue which we take very seriously. You're also talking about the equivalent of a medium-sized oil refinery—a huge footprint on the coast. And it would require enormous amounts of electricity to pump water."

The launch of a closed containment cage (left) at Campbell River, BC, in January will hopefully pave the way for the further introduction of alternative sustainable technologies in salmon farming.

Belle has it right about big, land-based farms, and no company could switch to them and still compete on the world market. But land-based farms wouldn't have to be big or come all at once. Already a small one in Washington State owned by AquaSeed Corporation is doing a brisk business selling to the organic market. Because the company has its own freshwater source, its fish are free of PCBs and other contaminants that reduce marketability of farmed fish. And because AquaSeed doesn't endanger the public or pollute the Pacific with feces, parasites, viruses, bacteria and warped genes, its product has been awarded "Super Green" status by the Monterey Bay Aquarium's respected Seafood Watch.

For major production a practical alternative, far safer than traditional farms, might be the type of fully contained, re-circulating 3,000-cubic-meter pen just launched by Agrimarine Industries and its conservation partners in B.C.'s Campbell River. It may even be possible to minimize pollution from traditional net pens by simultaneously growing products such as kelp and mussels that utilize the waste. A collaborative project by industry, the University of New Brunswick, and federal and provincial agencies is yielding promising results.

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"I don't know that you can get all the farms out of the sea right away," says Taylor. "Maybe it's a situation where it happens slowly, where there are no new sites licensed except closed-containment or land-based. That's the only way the industry makes sense. About 80% of Fundy production goes to the U.S. When the Canadian dollar was worth 65 cents salmon farmers had huge profit margins. The whole industry was based not on good practices but on making money by the exchange rate. Now that U.S. and Canadian dollars are pretty much the same, few of these operations are profitable."

Most salmon farms currently blighting the bay remain in business only because they're heavily subsidized, and without radical thinning and major Maine-style reforms they face almost certain doom. The Conservation Council of New Brunswick cites five tests for an industry's sustainability:

- It does not degrade the environment on which it is dependent.
- It is in harmony with other economic, cultural and social activities that use the same natural resources.
- It invests in local communities, and decision-making is local.
- It produces a reasonable and relatively stable net income to both producers and society by using natural resources on a long-term, renewable basis.
- It does not diminish the ability of future generations to use the same resources."

But salmon farming in the Bay of Fundy—and, for that matter, everywhere in Canada—fails all five tests. Lessons aren't being learned. New salmon farms are being proposed in Nova Scotia, not far from the pens opened by last fall's storms.

Retention of stock, containment of alien genes, reduction of parasites and pathogens—all the things that are good for wild salmon are good for farmed salmon. If the industry ever figures this out, it may have a bright, sustainable future.

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With improving technology and better transparency and accountability, salmon farming and wild fish can co-exist.

GILBERT VAN RYCKEV/ORSEL